

The background of the entire slide is a close-up, low-angle photograph of several dandelion seed heads. The seed heads are in various stages of maturity, with some showing the characteristic white, feathery pappus. The lighting is soft and diffused, creating a dreamy, ethereal atmosphere. The colors are muted, with a lot of white and light grey tones from the seeds, and some darker, brownish-green tones from the stems and the background foliage.

# **PROTOTYPE DESIGN FOR GLOBAL SEED BANK NETWORK**

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Instructor: Iker Gil

Illinois Institute Of Technology  
ARCH 523 Masters Project Preparation  
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# PROTOTYPE DESIGN FOR GLOBAL SEED BANK NETWORK

Student: Rusudan Margishvili  
Instructor: Iker Gil

“All human life, **all life depends on plants**. It does not matter if you live in a small African village or a big city - everything comes to plants in the end - whether it’s for the **food**, the **medicine**, the **fuel**, the **construction**, the **clothing**, all the obvious things; or whether it’s the **spiritual or recreational things** that matter to us so much; or whether it’s the **soil formation** or the effects on the atmosphere, or **primary produciton**. Damn it, even the **books** here are made out of plants. All these things, they come back to plants. And without them we would not be here.

Now **plants are under threat**. They are under threat because of the changing climate. And they are also under threat because they are sharing a planet with people like us. And people like us want to do things that destroy plants and their habitats. And whether it is because of the food production or the introduction of alien plants into places where they really oughtn’t be, or because of habitats being used for other purposes, all these things are meaning that plants have to adapt, or die, or move. And plants sometimes find it rather difficult to move, because there might be cities or other things on the way.

**So if all human life depends on plants, doesn’t it makes sense that perhaps we should try to save them?!”**

Johnathan Drori  
Main-Board Trustee of Millennium Seed Bank Project

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  - Economic conditions
  - Plant diversity
- Proposed network diagram

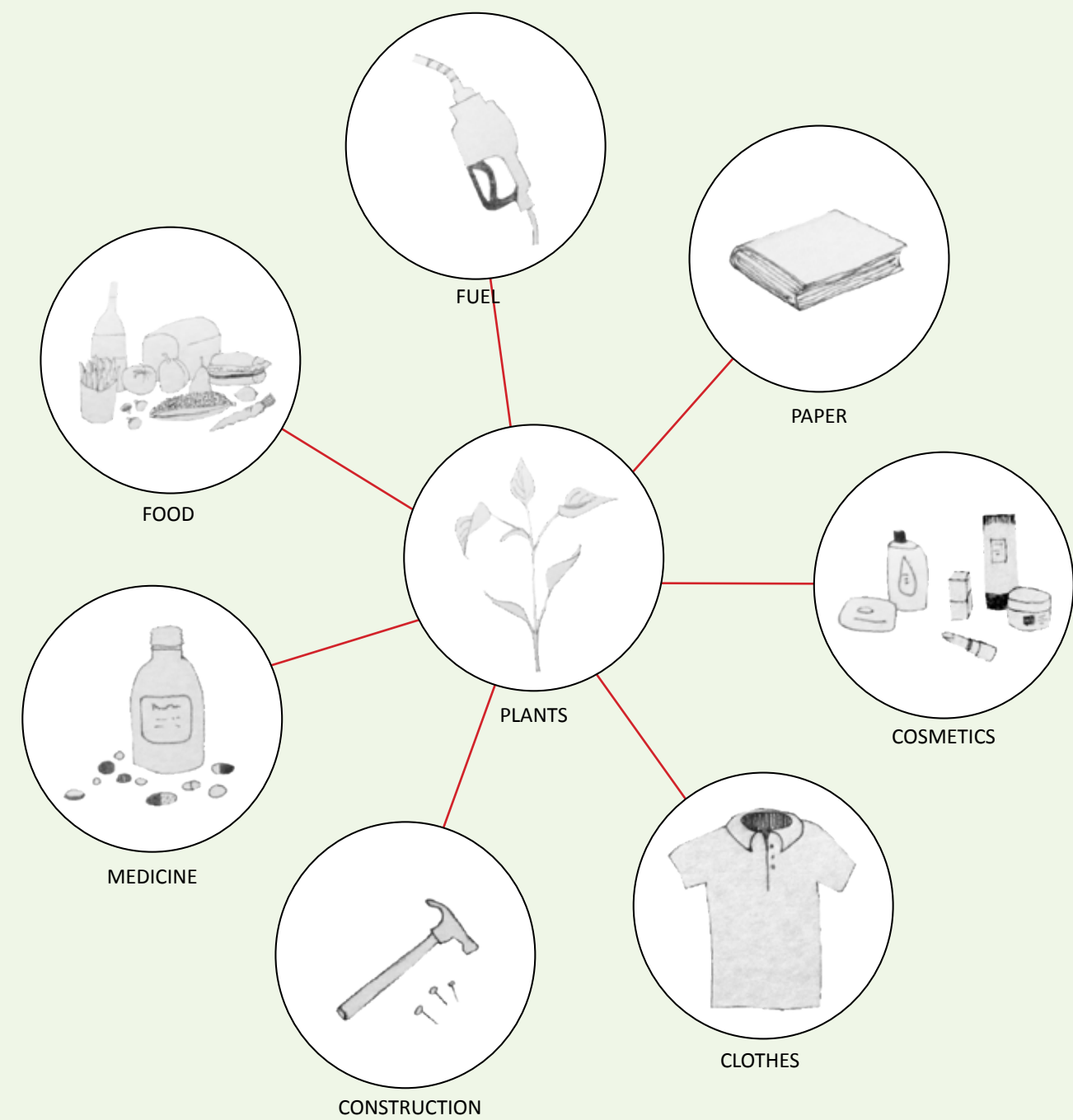
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A large, textured, white, cloud-like or smoke-like shape on a black background. The shape is irregular and billowing, with many internal folds and creases, giving it a three-dimensional, ethereal appearance. It is positioned on the right side of the frame, with its left edge partially overlapping the text.

**ABOUT THE PROJECT**

PLANTS & HUMANS



PLANTS, HUMANS & GLOBAL WARMING

RESULTS OF GLOBAL WARMING:

- **Glaciers could melt**, causing sea levels to rise while creating water shortages in regions dependent on runoff for fresh water.
- **Sea level could rise** 7 - 23 inches (18 - 59 cm) by century's end. Rises of just 4 inches (10 centimeters) could flood many South Seas islands and swamp large parts of Southeast Asia.
- Strong hurricanes, droughts, heat waves, wildfires, and other **natural disasters** in many parts of the world.
- **The growth of deserts** may cause **food shortages**.
- More than a million species face **extinction** from disappearing habitat, changing ecosystems, and acidifying oceans.
- The ocean's circulation system (ocean conveyor belt) permanently altered, causing a **mini-ice age in Western Europe** and other rapid changes.
- **Positive feedback effect** - rising temperatures could release additional greenhouse gases by unlocking methane in permafrost and undersea deposits, freeing carbon trapped in sea ice, and causing increased evaporation of water."

Source: National Geographic News. *Global Warming Fast Facts*. Updated 14 June 2007. News.National-Geographic.com. <[http://news.nationalgeographic.com/news/2004/12/1206\\_041206\\_global\\_warming.html](http://news.nationalgeographic.com/news/2004/12/1206_041206_global_warming.html)>

# ABOUT THE PROJECT

## A SIMPLE IDENTIFIER:

My project will be a prototype of seed banks.

## A SHORT DESCRIPTION:

My project will be about a network of banks/research centers **conserving genetic information of plants**, and researching possibilities of re-production and climate adjustment.

## A POINTED CASE STATEMENT:

My project will be developed because due to **climate change** a lot of plant species are in **danger of extinction**. As scientists assume, Arctic ice might totally disappear by 2040, which will, of course, cause the changes in water level and therefore, flood a large part of the Earth. They also assume, that by 2070 the lowest temperature will be the highest temperature any plants have ever experienced. So what happens to plants in such case becomes obvious - they die out; this will cause a chain reaction of fauna extinction, since they will have neither shelter nor food.

My project would be a prototype of seed bank for a **global network** spread throughout the world. I would like to propose locations for multifunctional centers in certain countries, which would be supplied by sub-centers located in others based on long term climate and economic predictions, as well as plant hardiness zones. The prototype building will be a **modular structure**, allowing each country to **select functions and size** appropriate to them.

The building will include seed storages and labs, where groups of scientists would register and dry collected seeds, then conserve and reproduce them; they will modify plants genetically to help them adjust to new climate conditions. The facility will also include educational facilities to help **rise public awareness** and temporary accommodation for travelling scientists.

# PROJECT GOALS

## The idea is important because...

life on the entire earth depends on plants. The results of global warming might be much more destructive in long term than a lot of people believe; once we loose species of live organisms without a trace, we might never get them back. And it is not just the specific species we lose, but the entire chain reaction tied to it.

Since the problem is global, it should be solved globally by **connecting all the resources** of the world.

## The project will solve...

issues of plant species extinction caused by global warming.

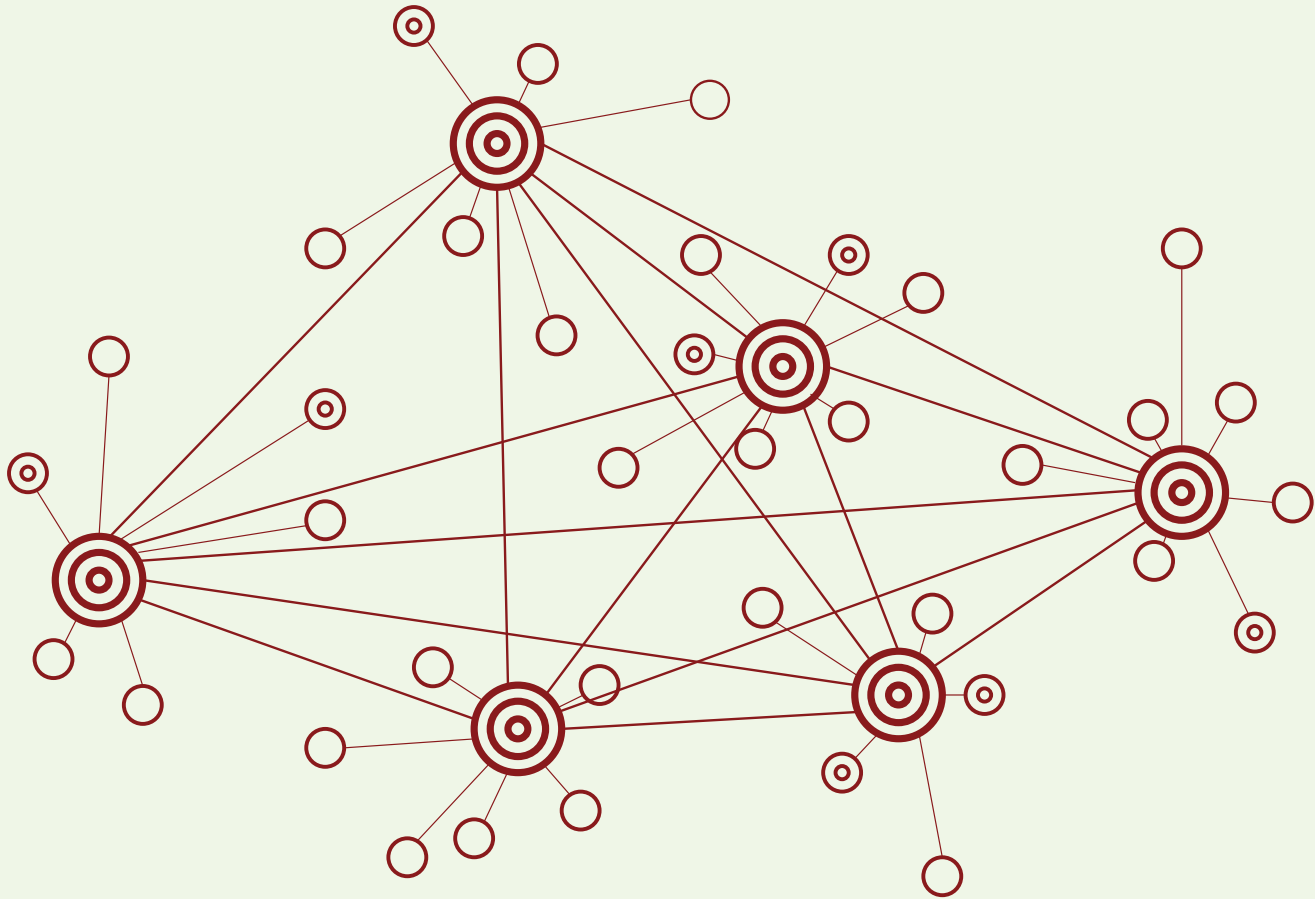
## The project will be successful...

by creating not only one or two centers for plant preservation, but by designing entire system, a **network of intellect and effort** of the world to fight for the green.

## POTENTIAL DESIGN RESPONSES:

- Creating a **net of genetic centers** in different parts of the world according to economical, political and environmental stability.
- Designing a **prototype** building which could work in different climate, seismic and nuclear conditions with the same success.
- Designing a flexible modular **system** allowing the countries “pick up” desirable functions and scale of a seed bank.
- Making the building as much **off-grid** and sustainable as possible.

# SEED BANK NETWORK



World floristic genetic information bank network will be spread throughout the world. The program will be distribed in the system of centers and sub-centers. Centers will be international, collecting seeds from different locations and acting as back-up system for sub-centers. They will contain educational and research facilities and will be large in scale, while sub-centers of regional or national meaning will contain only seed storages and green houses.

- LEGEND
  - National seed bank. Program: seed storages.
  - ⊙ Regional seed bank. Program: green houses, seed storages.
  - ⊛ International seed bank. Program: research labs, conservation labs, archiving facilities, exhibition halls and lecture rooms, green houses, seed storages, archives, temporary accommodation facilities for scientists.

# STAKEHOLDERS



Researchers collecting, drying and shipping seeds.

Facilities needed:



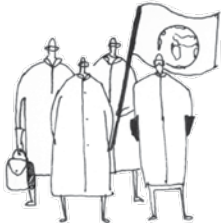
Botanists taking care of plants in greenhouses.

Facilities needed:



Researchers organizing, registering and storing seeds.

Facilities needed:



Visiting Scientists.

Facilities needed:



Researchers observing seed condition.

Facilities needed:

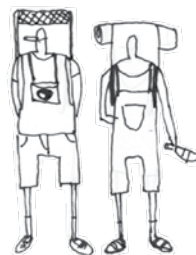


Volunteers.

Facilities needed:



## STAKEHOLDERS



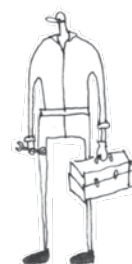
Tourists

Facilities needed:



## Security

Facilities needed:



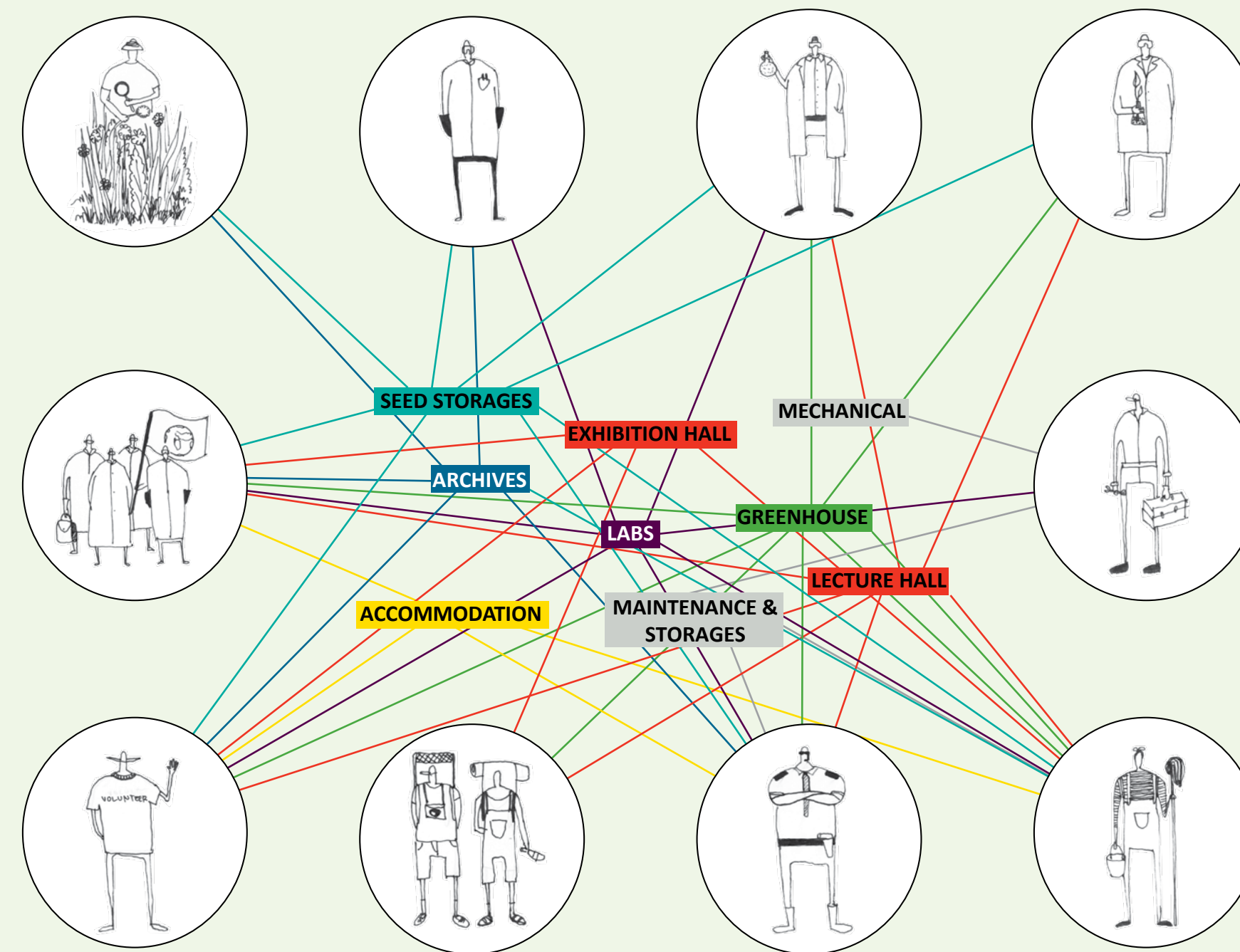
Mechanical system maintenance.

Facilities needed:



Cleaning and maintenance.

Facilities needed:







## CASE STUDIES



# SVALBARD GLOBAL SEED VAULT

Svalbard Global Seed Vault is an **underground “backup system”** for the world agriculture located about 810 miles from the North Pole. The location allows scientists freeze seeds without mechanical assistance.

## PROJECT DATA:

Architect: Peter W.Søderman  
Client: The Global Crop Diversity Trust (GCDT)  
Location: Longyearbyen, Svalbard, Norway  
Status: Completed 2009

Seed banks located around the world are vulnerable due to construction, economical, mechanical or political reasons. Scientists decided to find a safe place on the world, remote from political interests, where they could conserve and preserve different crops’ species without mechanical systems, so they chose Svalbard Island – the furthest undisturbed and uninhabited place which is still easy to reach by plane. Although this precedent was built purely for ecological reasons and has no public functions, I chose Svalbard Seed Vault because it is interesting for its natural processes and global politics. I also want to explore its storing strategies



# EDEN PROJECT

The **largest plant enclosure**, the Eden Project is a significant and innovative project for its structural solution, consisting of 8 inter-linked geodesic domes.

## PROJECT DATA:

Architect: Nicholas Grimshaw  
Client: The Eden Project LTD  
Engineer: Anthony Hunt and Associats  
Pr. Manager: Davis Langdon  
Constructor: Alfred McAlpine  
Biome: MERO  
Location: Cornwall, England  
Status: Completed 2001  
Area: 23,000 m2  
Budget: £57-£75 m

The greenhouse, the shape of which is a beautiful biomimicry of inter-linked soap bubbles, is a home of thousands of species. Innovative use of thermoplastic ETFE allowed the engineers create biomes shaped with very light hexagonal panels, which can span much bigger than glass panels. I would like to research the project’s mechanical and structural novelties and advanced technologies for the green house I plan to design for a prototype seed bank.

DESCRIPTION OF STRUCTIRE goes here



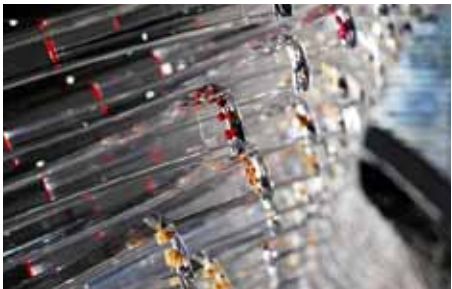
# THE SEED CATHEDRAL

UK pavilion at Shanghai Expo is a beautiful representation of **British long traditions of botanical gardens.**

## PROJECT DATA:

Architect: Heatherwick Studio  
Client: Government of UK  
Location: Shanghai, China  
Status: Completed 2010  
Area: 1,500 m2  
Budget: £25 m

Significance of this project is in a different approach to plant presentation – in place of building a greenhouse, Heatherwick studio took seeds to define plants, to highlight how unique and beautiful the beginning of each plant can look like and turned seeds into the jewelry of the pavilion. I would like to research the pavilion as a successful and poetic example of plant exhibition.



# INSTITUTE OF THE BOTANICAL GARDEN OF BARCELONA

Short Description:

## PROJECT DATA:

Case Statement:

# EDF ARCHIVES CENTER

Simple and elegant archive building in France **can store 70 kilometer of shelves** (43.5 miles) for paper-based and microfilm-based archived material providing maximum fire protection and constant temperature and humidity.

## PROJECT DATA:

Architect: LAN Architecture  
Client: EDF  
Pr.Manager: Christophe Leblond  
Location: Bure-Saurdon, France  
Status: Completed 2008  
Area: 6,800 m2

The reason why I got interested in the case is the storing strategies the architects chose – archives are composed by 20 similar storehouses on 5 floors; the design team worked on different floor heights to get the maximum out of the minimum amount of the built-up area. I would like to research how they hybridized storage spaces with offices, and study their plans and section drawings, as well as mechanical and fire protection systems.



# EXISTING SEED BANKS



- LEGEND
- Taxonomic Seed Bank
  - Local Seed Bank
  - National Seed Bank
  - International Seed Bank
- \* ENSCONET - Regional seed bank, coordinates seed activities in Europe

\* Location of seed banks might not be accurate.

Sources:

- BGCI Plants of the Planet. *Seed Banks*. Resource Center. Botanic Garden Information. Web. < <http://www.bgci.org/resources/seedbanks/>>
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# MILLENNIUM SEED BANK PROJECT

**The largest seed bank of the world** Millennium Seed Bank is an international conservation project and research center, a “living library” of over 3 billion seeds, which contains visitor center, as well as residential and educational science facilities.

## PROJECT DATA:

Architect: Stanton Williams  
Client: The Royal Botanic Gardens Kew  
Location: Wakehurst Place, West Sussex, England  
Status: Completed 2000  
Budget: £14.0 m

The seed bank was formed to prevent extinction of plant species by storing their seeds and using them in future. Millennium Seed Bank has a global importance; the groups of scientists are responsible for conserving seeds from the entire world - by 2020 the seed bank plans to have species of flora representing 25% of global plant types. They study genetic information of species, take care of their germination tests of every sample in every 10 years, reproduce seeds and send back to their native lands to restore the natural habitat. The building is an interesting hybrid of public and private facilities: offices for scientists are mixed with public exhibition spaces, so that visitors could see how important plant studies are and be inspired by the research process. There are also completely isolated, underground zones with constant temperature and humidity level and the climate control is done very energy efficiently. I believe that studying that building will help me understand the process of plant conservation, spatial and technical needs and public involvement level for my project.





**SITE**

SITE SELECTION CRITERIAS:

1. GEOGRAPHICAL CHANGES

As mentioned before, scientists predict the **rise of water level by 7 to 23 inches** (18 to 59 centimeters) in the entire world. Since the seed banks are crucial for survival, I need to make sure to pick up flood-safe locations.

World Map 2050 - Flooding caused by the change of water level by 100 meters (328’)

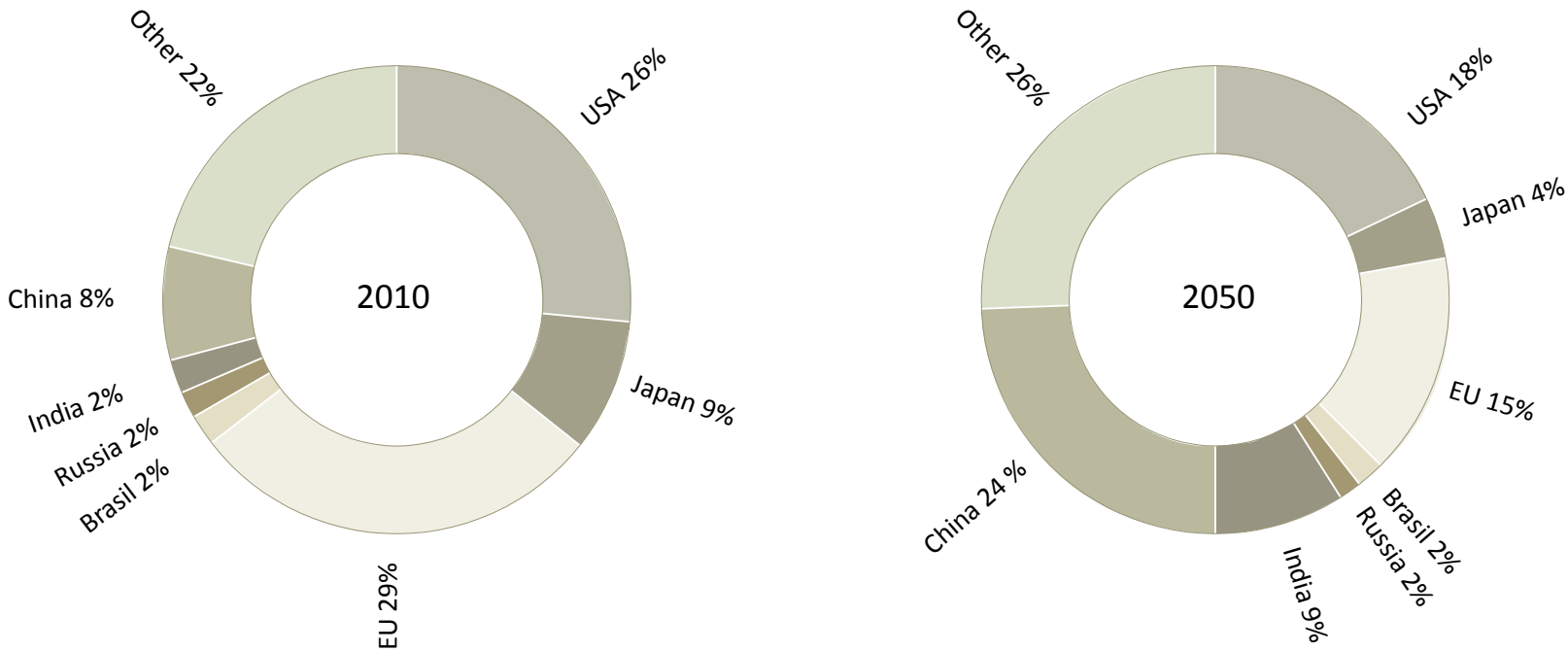


\*Source: Buffalo Web. < <http://vrstudio.buffalo.edu/~depape/warming/World100-8190.jpg>>

2. ECONOMIC CONSISTENCY

According to the main-Board Trustee of Millenium Seed Bank Project Johnathan Drori, maintenance and research funds for Millennium Seed Bank is reaching ten million dollars annually. Maintaining the central buildings of the bank network will need a **strong economical background and consistency**, so the location is resulted by world GDP current projection and future predictions.

Regional shares of the world GDP in 2010 and 2050



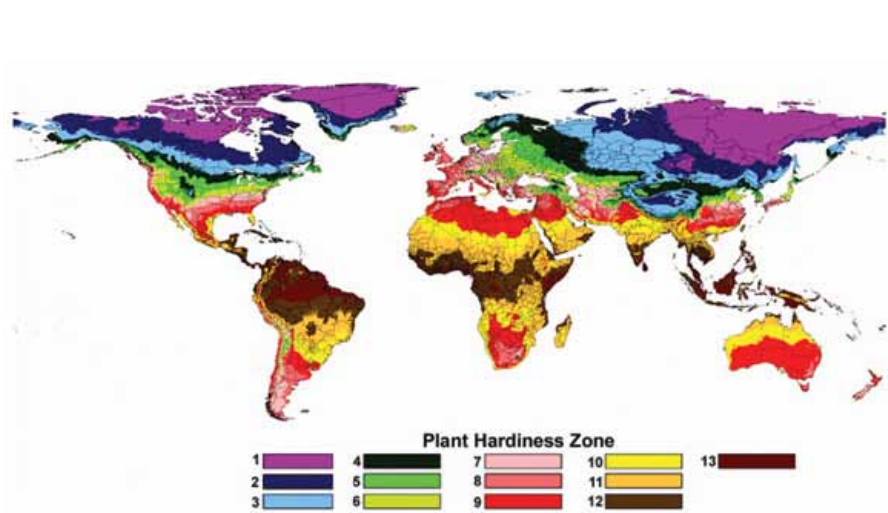
\*Source: *Global Europe 2050. Executive Summary*. European Commission, European Research Area, Social Sciences and Humanities. Web. October 2011. <[http://ec.europa.eu/research/social-sciences/pdf/global-europe-2050-summary-report\\_en.pdf](http://ec.europa.eu/research/social-sciences/pdf/global-europe-2050-summary-report_en.pdf)>



3. FLORA DIVERSITY

While locating sub-centers, I need to find **home for each type of plant**, keeping in mind distances for transportation. Plant hardiness zones help me identify location needs regional centers, while plant diversity hotspots locate both national, and regional seed banks.

THIRTY-YEAR GLOBAL PLANT HARDNESS ZONE MAP FOR THE PERIOD 1978-2007

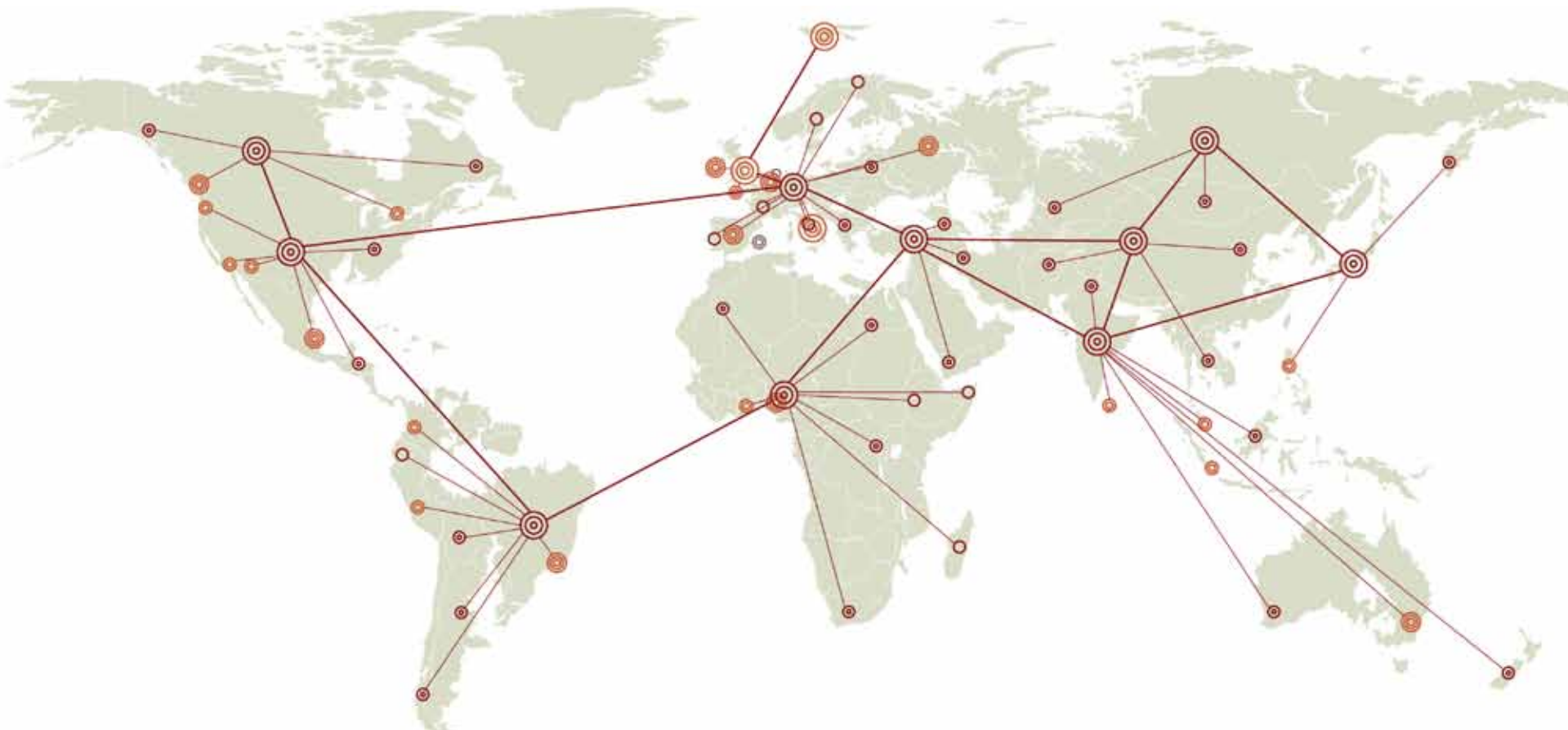


PLANT DIVERSITY HOTSPOTS



\*Source:  
• Scientia Agricola. *Global plant hardiness zones for phytosanitary risk analysis*. (Piracicaba, Braz.) vol.65 no.spe Piracicaba. Dec. 2008. Web. <[http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0103-90162008000700009](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-90162008000700009)>

PROPOSED SEED BANK NETWORK



LEGEND

Taxonomic Seed Bank

Local Seed Bank

National Seed Bank

International Seed Bank

Taxonomic Seed Bank with high chance to be flooded

National Seed Bank with high chance to be flooded

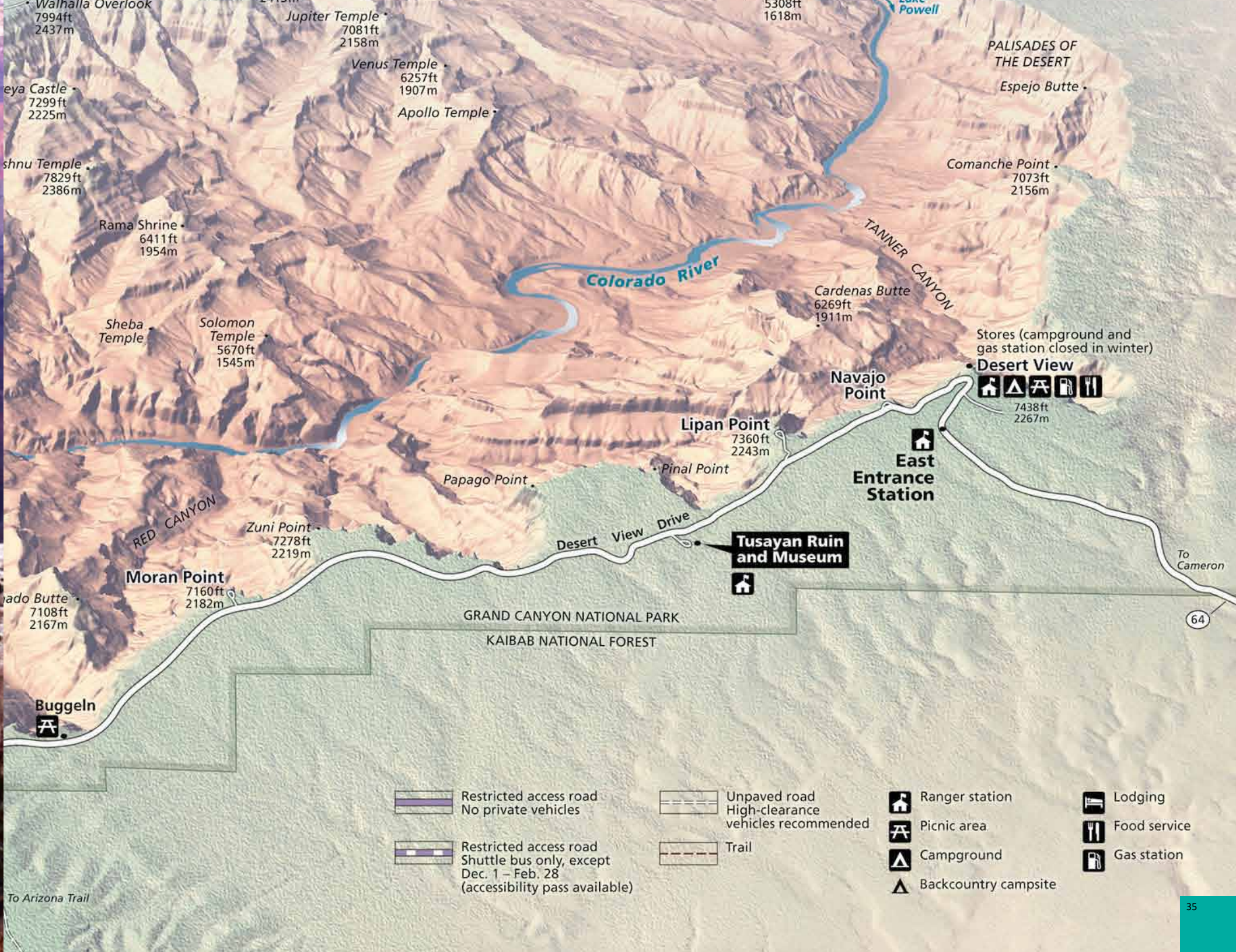
Proposed National Seed Bank

Proposed Regional Seed Bank

Proposed International Seed Bank



SITE PROPOSAL IN USA



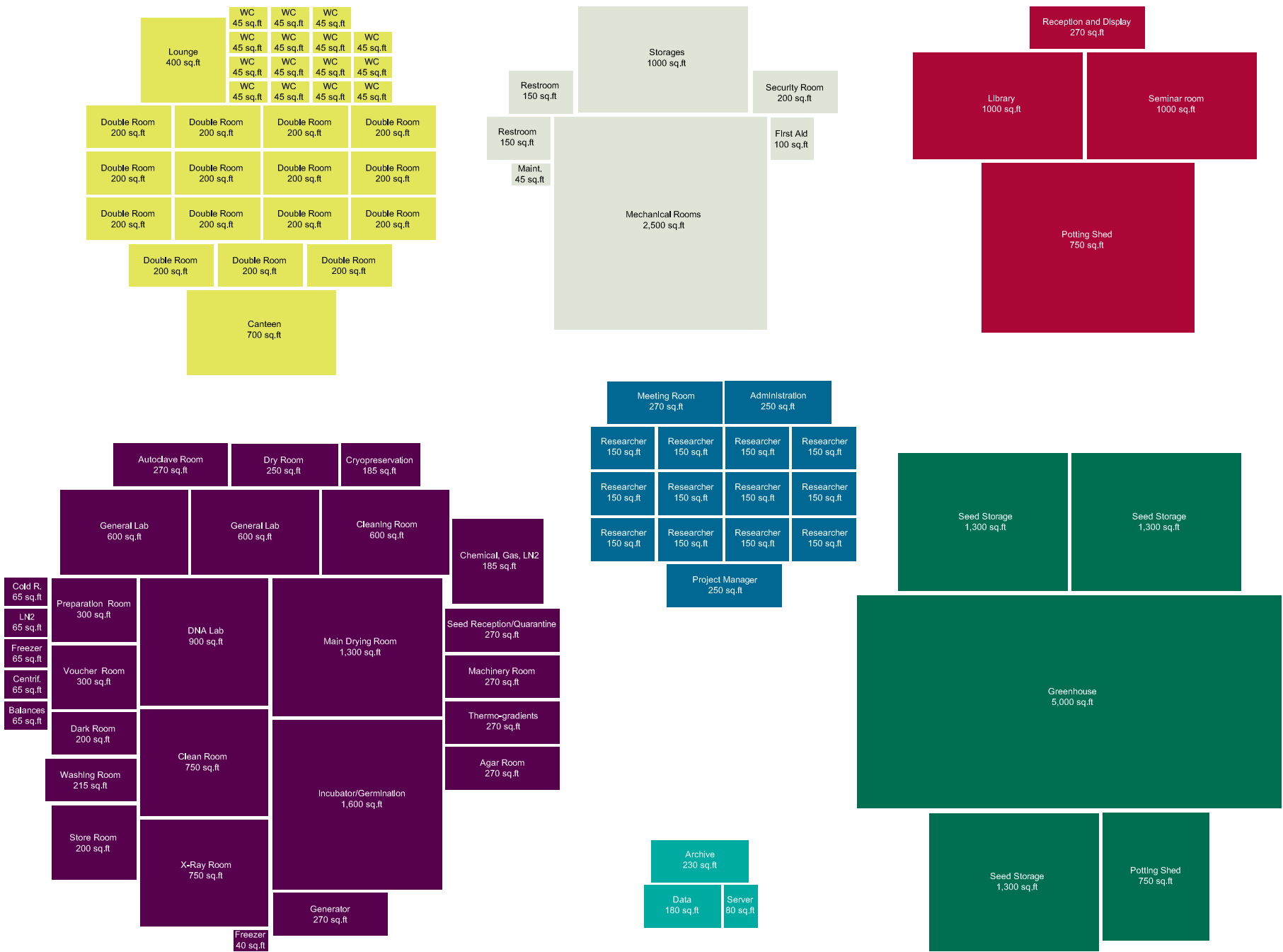




PROGRAM



PROGRAM



FUNCTIONAL RELATIONSHIPS

QUANTITATIVE ANALYSIS

WORKSPACES	qty	net sq.ft	total net sq.ft	Notes
Administration Office	1	250	250	
Project Manager’s Office	1	270	270	
Researcher’s Office	12	150	1,800	
Meeting Room	1	270	270	

TOTAL SQ.FT 2,590

LABS	qty	net sq.ft	total net sq.ft	Notes
General Lab	2	600	1,200	
Seed Reception/quarantine	1	270	270	
Machinery Room	1	270	270	
Voucher Room (?)	1	300	300	
Incubator/Germination	1	1,600	1,600	
Thermo-gradients	1	270	270	
DNA Lab	1	900	900	
Centrifuge Room	1	65	65	
Freezer	1	65	65	-94° F (-70° C) temperature needed
Freezer	1	40	40	-94° F (-70° C) temperature needed
Clean Room	1	750	750	
Cleaning Room	1	600	600	
Washing Room	1	215	215	
Main Drying Room	1	1,300	1,300	
Dry Room	1	250	250	
Cold Room	1	65	65	
Preparation Room Ovens	1	300	300	
LN² Room	1	65	65	
Agar Room	1	270	270	
Autoclave Room	1	230	230	Space for autoclave device for equipment sterilization
Balances	1	65	65	
Tissue Culture/Cryopreservation	1	185	185	
Chemical, Gas and LN² Store	1	430	430	
Generator	1	270	270	
X-ray Room	1	750	750	
Store Room	1	350	350	
Dark Room	1	200	200	

TOTAL SQ.FT 11,275

DATA MANAGEMENT	qty	net sq.ft	total net sq.ft	Notes
Archive	1	230	230	
Data	1	180	180	
File Server	1	80	80	

TOTAL SQ.FT 490

PLANTS AND SEEDS	qty	net sq.ft	total net sq.ft	Notes
Seed Storage	3	1,300	3,900	-94° F (-70° C) temperature needed
Greenhouse	1	5,000	5,000	Needs a link to the labs
Potting Shed	1	750	750	

TOTAL SQ.FT 5,750

PUBLIC AWARENESS	qty	net sq.ft	total net sq.ft	Notes
Reception and Public display	1	270	270	
Exhibition Space	1	2,000	2,000	
Seminar Room	1	1,000	1,000	
Library	1	1,000	1,000	

TOTAL SQ.FT 4,270

ACCOMMODATION	qty	net sq.ft	total net sq.ft	Notes
Double Room	15	200	3,000	
Bathroom	15	45	675	
Lounge	1	400	400	
Canteen	1	700	700	

TOTAL SQ.FT 6,450

BUILDING SUPPORT	qty	net sq.ft	total net sq.ft	Notes
Restrooms	2	150	300	
Security Room	1	200	200	
Maintenance Room	1	45	45	
First Aid	1	100	100	
Storages	1	1,000	1,000	
Mechanical Rooms	1	2,500	2,500	

TOTAL SQ.FT 4,145

+ 10% circulation

TOTAL AREA 38,467



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